

WHAT IS CLAIMED IS:

1. A method of forming an amorphous silicon-based film on a substrate located inside a deposition chamber, comprising:

5 introducing a silicon-based volatile into the deposition chamber;

introducing into the deposition chamber a conductivity-increasing volatile including one or more components for increasing the conductivity of the amorphous silicon-based film; and

10 introducing into the deposition chamber a conductivity-decreasing volatile including one or more components for decreasing the conductivity of the amorphous silicon-based film.

15 2. The method of claim 1, wherein the conductivity-increasing volatile and the conductivity-decreasing volatile are introduced into the deposition chamber at respective relative flow rates selected to achieve a desired film resistivity.

20 3. The method of claim 2, wherein the relative flow rates are selected to achieve a film resistivity of about 10^3 - 10^7 ohm-cm.

4. The method of claim 1, wherein the conductivity-increasing volatile consists of phosphine and the conductivity-decreasing volatile consists of ammonia, the phosphine and the ammonia being introduced into the deposition chamber at a flow rate ratio in a range of about 1:1000 to about 1:10 (phosphine:ammonia).

25 5. The method of claim 1, wherein the conductivity-increasing volatile consists of phosphine and the conductivity-decreasing volatile consists of methane, the phosphine and the methane being introduced into the deposition chamber at a flow rate ratio in a range of about 1:100 to about 1:1 (phosphine:methane).

30 6. The method of claim 1, wherein the conductivity-increasing volatile includes a dopant.

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7. The method of claim 6, wherein the dopant includes an n-type dopant.

8. The method of claim 7, wherein the n-type dopant includes phosphorous.

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9. The method of claim 6, wherein the dopant includes a p-type dopant.

10. The method of claim 9, wherein the p-type dopant includes boron.

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11. The method of claim 1, wherein the amorphous silicon-based film is characterized by a band gap, and the conductivity-decreasing volatile includes a band gap increasing component that increases the band gap of the amorphous silicon-based film relative to a film formed under similar conditions but without the band gap increasing component.

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12. The method of claim 1, wherein the conductivity-decreasing volatile includes nitrogen.

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13. The method of claim 12, wherein the conductivity-decreasing volatile includes ammonia.

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14. The method of claim 1, wherein the conductivity-decreasing volatile includes N₂O.

15. The method of claim 1, wherein the conductivity-decreasing volatile includes carbon.

16. The method of claim 15, wherein the conductivity-decreasing volatile includes methane.

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17. The method of claim 1, wherein the silicon-based film consists of silane, the conductivity-increasing volatile consists of phosphine, and the

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conductivity-decreasing volatile consists of ammonia.

18. The method of claim 1, wherein the silicon-based film consists of silane, the conductivity-increasing volatile consists of phosphine, and the conductivity-decreasing volatile consists of methane.

5 19. The method of claim 1, further comprising introducing into the deposition chamber a second conductivity-decreasing volatile.

10 20. The method of claim 19, wherein the silicon-based film consists of silane, the conductivity-increasing volatile consists of phosphine, the first conductivity-decreasing volatile consists of ammonia, and the second conductivity-decreasing volatile consists of methane.

15 21. A field emission display device having a substrate fabricated according to claim 1.

20 22. An electronic device having a substrate fabricated according to claim 1.

23. A flat panel display device having a substrate fabricated according to claim 1.

25 24. A method of forming an amorphous silicon-based film on a substrate located inside a deposition chamber, comprising:

introducing a silicon-based volatile into the deposition chamber;
introducing phosphine into the deposition chamber; and
introducing a nitrogen-containing volatile into the deposition chamber.

30 25. A field emission display device having a substrate fabricated according to claim 24.

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26. An electronic device having a substrate fabricated according to claim
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5 27. A flat panel display device having a substrate fabricated according to
claim 24.

28. A method of forming an amorphous silicon-based film on a substrate
located inside a deposition chamber, comprising:

10 introducing a silicon-based volatile into the deposition chamber;
introducing phosphine into the deposition chamber; and
introducing a carbon-containing volatile into the deposition chamber.

15 29. A field emission display device having a substrate fabricated according
to claim 28.

30. An electronic device having a substrate fabricated according to claim
28.

20 31. A flat panel display device having a substrate fabricated according to
claim 28.